A. Zulian

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Geology of Pioneer Bore

At your request an inspection of the Pioneer Bore was made December 11th and December 15th, 1959 by our engineering geologist, Stanley Mitchell assisted by Ralph Rhodes, a geologist attached to the Design Section. The purpose of this inspection was to make a geologic log of the Pioneer Bore and to establish limits for the need of concrete lining.

The Pioneer Bore was excavated last summer through a steep sided ridge located two miles east of Idaho Springs. The bore is approximately 800 feet long and 8 by 7 feet in cross section.

The bedrock through which it was cut consists of schist and gneiss of the Idaho Springs Formation. The U.S. Geological Survey has classified the rock as a quartzmonzonite gneiss of Pre-Cambrian age. The foliation or bedding of the gneiss parallels closely the alignment of the tunnel and dips 40 to 70 degrees to the north.

At the west portal the formation has been folded and faulted. The rock has been sheared and crushed to some extent and shows considerable alteration by weathering processes. The foliation shows overturning to the south opposite the proposed right lane tunnel. Thin veins of pyrite ($FeSO_4$) were noted along the fault both in the bore and west of the portal. Water follows up along the fault and comes out into the bore in several places. The water was tested by the Chemistry Section and the tests indicate very little acidity or presence of sulfates. However, this does not preclude the possibility that the water may become acid and charged with sulfates at a future date, particularly is its circulation is restricted. The presence of pyrites suggests this possibility.

The effects of faulting are evident in the Pioneer Bore between Stations 173+10 to 174+90. Timber sets have been necessary in several places to help stabilize the roof. Some of the rocks tend to expand and slab off. Several layers of biotite schist, along with fault gouge and seepage, indicate locations of fault zones. The rocks in this area show jointing at approximately right angles to the foliation, and this jointing still further weakens the rock.

East of Station 175+00 the bedrock gneiss is harder, less weathered and appears to be reasonably sound, except for joints which tend to break the formation into disconnected slabs. Most of the joints appear to be tight except near the east portal. Here the formations show the effects of weathering and some open joints back approximately 40 feet from the portal.

The location of the faulted zone, weathering, the strike and dip of the foliation and joints have been plotted on the attached geologic log both in plan and in sections. This information can assist the engineer in determining the probable limits for concrete lining in both the left and right lane tunnels. The suggested limits shown for concrete lining are based upon rock conditions found in the Pioneer Bore. It is possible that the rock structure in the right lane tunnel might not be found to exist exactly as

projected on the Geologic Log. However, we feel the rock conditions between Stations 173+20 and 175+20 me be similar to that found in the Pioneer Bore and may need to be concrete lined. The exact limits can be better determined at the time of excavation.

The original determination of the width of the pillar between the left and right lane tunnels was predicted upon the existence of relatively solid rock. However, the excavation made for eh west portals and Pioneer Bore indicates a zone of relatively weak rock between Stations 173 and 175. The structure and character of the rock between these stations suggests the need for a reevaluation of the pillar width, or consideration be given to extra support for the tunnel linings. We suggest that an expert in mining engineering be consulted on this matter before final plans and specifications are finalized.

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